

## Whole Numbers

The numbers 1, 2, 3, are called natural numbers or counting numbers.

Let us add one more number i.e., zero (0), to the collection of natural numbers. Now the numbers are 0,1,2, ... These numbers are called whole numbers

We can say that whole nos. consist of zero and the natural numbers. Therefore, except zero all the whole nos. are natural numbers.

### Facts of Whole numbers

- 1) The smallest natural number is 1.
- 2) The number 0 is the first and the smallest whole nos.
- 3) There are infinitely many or uncountable numbers of whole-numbers.
- 4) All natural numbers are whole-numbers.
- 5) All whole-numbers are not natural numbers. For example, 0 is a whole-number but it is not a natural number.

### The first 50 whole nos. are

0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13,14, 15, 16, 17, 18, 19, 20, 21,22, 23, 24, 25,26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40,41, 42, 43, 44, 45, 46, 47, 48, 49, 50

### Some other Important terms to remember

<b>SUCCESSOR</b>	The successor of a whole number is the number obtained by adding 1 to it. Clearly, the successor of 1 is 2; successor of 2 is 3; successor of 3 is 4 and so on.
<b>PREDECESSOR</b>	The predecessor of a whole number is one less than the given number. Clearly, the predecessor of 1 is 0; predecessor of 2 is 1; predecessor of 3 is 2 and so on. The whole number 0 does not have any predecessor.

### 1. Write the successor of

(a) 1070110701      (b) 100499100499      (c) 50999995099999      (d) 56705670

### 2. Write the predecessor of

(a) 1414 (b) 100000100000 (c) 80908090 (d) 43214321

### Solution

1. a) 1070210702

b) 100500100500

c) 51000005100000

d) 56715671

2.a) 1213

b) 9999999999

c) 80898089

d) 43204320

## **Properties of Whole Numbers**

### **Closure Property**

#### **Closure property on Addition for Whole Number**

$$0 + 2 = 2 \quad 20 + 2 = 22$$

$$1 + 3 = 4 \quad 11 + 3 = 14$$

$$5 + 6 = 11 \quad 55 + 6 = 61$$

#### **So Whole number are closed on Addition**

#### **Closure property on Multiplication for Whole Number**

$$0 \times 2 = 0 \quad 00 \times 2 = 0$$

$$1 \times 4 = 4 \quad 11 \times 4 = 44$$

$$5 \times 1 = 5 \quad 55 \times 1 = 55$$

#### **So Whole number are closed on Multiplication**

#### **Closure property on subtraction of Whole number**

$$5 - 0 = 5 \quad 55 - 0 = 55$$

$$0 - 5 = ? \quad 0 - 5 = ?$$

$$1 - 3 = ? \quad 1 - 3 = ?$$

$$3 - 1 = 2 \quad 23 - 1 = 22$$

#### **So Whole number are not closed on Subtraction**

#### **Closure property on Division of Whole number**

$$21 = 21 \quad 21 = 21$$

$$12 = ? \quad 12 = ?$$

$$02 = 0 \quad 02 = 0$$

$$20 = ? \quad 20 = ? \quad (\text{Division by Zero is undefined})$$

#### **So Whole Number are not closed on Division**

**In short**

<b>Closure Property</b>	If a and b are any two whole numbers, then $a + b$ , $a \times b$ are also whole numbers.
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### Commutative property

Commutativity property on Addition for Whole Number

$$0 + 2 = 2 + 0 = 2 \quad 20 + 2 = 2 + 0 = 2$$

**So Whole number are Commutative on Addition**

Commutativity property on Multiplication for Whole Number

$$0 \times 2 = 0 \text{ or } 2 \times 0 = 0 \quad 00 \times 2 = 0 \text{ or } 2 \times 0 = 0$$

**So Whole number are Commutative on Multiplication**

Commutativity property on subtraction of Whole number

$$5 - 0 = 5 \quad 55 - 0 = 5 \text{ but } 0 - 5 = ? \quad 0 - 5 = ?$$

**So Whole number are not Commutative on Subtraction**

Commutativity property on Division of Whole number

$$21 = 2 \quad 221 = 2 \text{ but } 12 = ? \quad 12 = ?$$

**So Whole Number are not Commutative on Division**

In short

You can add two whole numbers in any order. You can multiply two whole numbers in any order.

<b>Commutative property</b>	If a and b are any two whole numbers, then $a + b = b + a$ and $a \times b = b \times a$
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### Associative property

Associativity property on Addition for Whole Number

$$0 + (2 + 3) = (0 + 2) + 3 = 5 \quad 50 + (2+3) = (0 + 2) + 3 = 5$$

$$1 + (2+3) = 6 = (1 + 2) + 3 \quad 31 + (2+3) = 6 = (1+2) + 3$$

**So Whole number are Associative on Addition**

Associativity property on Multiplication for Whole Number

$$0 \times (2 \times 3) = 0 \quad 00 \times (2 \times 3) = 0 \text{ or } (0 \times 2) \times 3 = 0 \quad (0 \times 2) \times 3 = 0$$

**So Whole number are Associative on Multiplication**

Associativity property on subtraction of Whole number

$$10 - (2 - 1) = 9 \quad 910 - (2 - 1) = 9 \text{ but } (10 - 2) - 1 = 7 \quad (10 - 2) - 1 = 7$$

**So Whole number are not Associative on Subtraction**

**Associativity property on Division of Whole number**

$$16 \div (4 \div 2) = 8 \quad 16 \div (4 \div 2) = 8 \text{ but } (16 \div 4) \div 2 = 2 \quad (16 \div 4) \div 2 = 2$$

So Whole Number are not Associative on Division

So in Short

If a, b and c are any two whole numbers, then  $(a + b) + c = a + (b + c)$  and  $(a \times b) \times c = a \times (b \times c)$ .

**Distributive property**

If a, b and c are any two whole numbers, then  $a(b + c) = a \times b + a \times c$  and  $(b + c)a = a \times b + a \times c$

**Additive Identity**

If a is any whole number, then  $a + 0 = a = 0 + a$

**Example**

$$2 + 0 = 2 \quad 2 + 0 = 2$$

$$0 + 3 = 3 \quad 0 + 3 = 3$$

$$5 + 0 = 5 \quad 5 + 0 = 5$$

**Multiplicative Identity**

If a is any whole number, then  $a \times 1 = a = 1 \times a$

**Example**

$$1 \times 1 = 1 \quad 1 \times 1 = 1$$

$$5 \times 1 = 5 \quad 5 \times 1 = 5$$

$$6 \times 1 = 6 \quad 6 \times 1 = 6$$

**Multiplication by zero**

If a is any whole number, then  $a \times 0 = 0 = 0 \times a$

**Example**

$$1 \times 0 = 0 \quad 1 \times 0 = 0$$

$$5 \times 0 = 0 \quad 5 \times 0 = 0$$

$$0 \times 0 = 0 \quad 0 \times 0 = 0$$

**Division by zero**

If a is any whole number, then  $a \div 0$  is not defined

## Quiz Time

**Question 1** Which of the following is not defined?

- A)  $10 + 0$   $10 + 0$
- B)  $10 - 0$   $10 - 0$
- C)  $10 \times 0$   $10 \times 0$
- D)  $10 \div 0$   $10 \div 0$

**Question 2** Find the value of  $6536 (?) 91 + 9 (?) 6536$

- A) 588240
- B) 594776
- C) 58824
- D) 653600

**Question 3** Which of the following is true

- A) Every whole number has predecessor
- B) The product of two whole numbers need not to be whole number
- C) 1 is the identity for multiplication of whole numbers.
- D) 1 is the identity for addition of whole numbers.

**Question 4** Which of the following is not true

- A) Whole number are closed on addition
- B) Whole number are Commutative on Multiplication
- C) Whole number are Commutative on Subtraction
- D) Whole number are Commutative on addition

**Question 5** The product of a non-zero whole number and its successor is always?

- A) even number
- B) odd number
- C) prime number
- D) divisible by 5

## Multiplication and Division

### What is Multiplication?

Multiplication is the repeated addition of a number. If we multiply m by n, that means m is repeatedly added to itself for n times. The symbol for multiplication is '×'.

For instance, 8 multiplied by 4 is equal to 32. How? Adding 8, 4 times to itself, we get;

$$8 + 8 + 8 + 8 = 32$$

Therefore, we can write,

$$8 \times 4 = 32$$

### What is Division?

The division is a method of dividing or distributing a number into equal parts, For example, if 16 is divided by 4, then 16 is divided into 4 equal parts. Therefore, the resultant value is 4.

$$16 \div 4 = 4$$

### Parts of division

**Dividend ÷ Divisor = Quotient**

$$15 \div 3 = 5$$

In the above example, there are three parts for division.

- 15 is dividend
- 3 is divisor
- 5 is quotient (R.H.S)

### Multiplication and Division Relationship

Multiplication and division, are inverse operations of each other. If we say, a multiplied by b is equal to c, then c divided by b results in a. Mathematically, it can be represented as:

- $a \times b = c$
- $c \div b = a$

For example,

- $4 \times 5 = 20$  [4 multiplied by 5 results in 20]
- $20 \div 5 = 4$  [20 divided by 5 returns back 4]

### Multiplication and Division Rules

For every mathematical computation, we need to follow the rules. Thus even to multiply and divide the numbers, there are some rules which we need to follow.

#### Rule 1: Order of operations

The order of operations for multiplication does not matter. It means if we arrange the number in a different order while multiplying them, then the result will be the same.

Examples are:

$$3 \times 4 = 12$$

$$4 \times 3 = 12$$

In the above example, we can see, even if we have swapped the position of 3 and 4, the product of the two integers is equal to 12.

But this rule is not applicable for division. Let us take another example.

$$12 \div 3 = 4$$

$$3 \div 12 \neq 4 \text{ (it is equal to 0.25)}$$

Thus, we cannot change the order of numbers in division method.

### Rule 2: Multiplying and Dividing by Positive Numbers

If any real number is multiplied or divided by the positive real number, then the sign of the resulting number does not change.

Examples are:

$$2 \times 3 = 6$$

$$-2 \times 3 = -6$$

Since, 2 and 3 both are positive integers, therefore the product of 2 and 3 is also positive. But the product of -2 and 3 is a negative number.

$$4 \div 2 = 2$$

$$-4 \div 2 = -2$$

Since, 4 and 2 both are positive, therefore, 4 divided by 2 is also a positive number. But -4 divided by 2 is a negative number.

Thus, we can conclude that:

$$(+ ) \times (+ ) = (+ )$$

$$(+ ) \div (+ ) = (+ )$$

$$(- ) \times (+ ) = (- )$$

$$(- ) \div (+ ) = (- )$$

### Rule 3: Multiplying and Dividing by Negative Numbers

Multiplication and division of any real number by a negative number will change the sign of the resulting number. Examples are given below.

#### 1. Multiply 5 by -2.

$$5 \times -2 = -10$$

#### 2. Multiply -5 by -2.

$$-5 \times -2 = 10$$

#### 3. Divide 10 by 2.

$$10 \div -2 = -5$$

$$-10 \div -2 = 5$$

Thus we can conclude that:

$$(+)\times(-)=(-)$$

$$(+)\div(-)=(-)$$

$$(-)\times(-)=(+)$$

$$(-)\div(-)=(+)$$

### Summary of Multiplication and Division Rules

Multiplication rules	Division rules
<ul style="list-style-type: none"> <li><math>(+)\times(+)=(+)</math></li> <li><math>(-)\times(-)=(+)</math></li> <li><math>(+)\times(-)=(-)</math></li> <li><math>(-)\times(+)=(-)</math></li> </ul>	<ul style="list-style-type: none"> <li><math>(+)\div(+)=(+)</math></li> <li><math>(-)\div(-)=(+)</math></li> <li><math>(+)\div(-)=(-)</math></li> <li><math>(-)\div(+)=(-)</math></li> </ul>

### Multiplication and Division of Integers

Integers are those values that are not fractions and can be negative, positive or zero. The integers can be easily represented on a number line. Thus, the arithmetic calculations on integers can be done in a simple manner.

Multiplying and dividing any integer with a whole number, or a fraction or an integer itself is given below with examples.

- $3 \times 9 = 27$  (Integer  $\times$  Whole number)
- $2 \times \frac{1}{4} = \frac{1}{2}$  (Integer  $\times$  Fraction)
- $2 \times -5 = -10$  (Integer  $\times$  Integer)

### Multiplication and Division of Fractions

Here, we will learn how to multiply and divide fractions with examples.

A fraction is a part of a whole. For example,  $\frac{1}{2}$  is a fraction that represents half of a whole number or any value. Here, the upper part is called the numerator and the lower part is called the denominator. Let us multiply and divide fractions with examples.

$$\frac{1}{4} \times \frac{1}{2} = (1 \times 1)/(4 \times 2) = \frac{1}{8}$$

$$\frac{1}{4} \div \frac{1}{2} = (1 \times 2)/(1 \times 4) = \frac{2}{4} = \frac{1}{2}$$

### Multiplication and Division of Decimals

Decimals are numbers with a decimal point, (Eg: 2.35). They represent the fraction of something or some value, such as  $\frac{1}{2} = 0.5$ . A decimal notation or point differentiates an integer part from fractional part (e.g.  $2.35 = 2 + \frac{7}{20}$ ).

### Multiplication of Decimals

When a decimal is multiplied by any real number, then the position of the decimal point (.) changes.



**For example:**  $0.33 \times 2 = 0.33 + 0.33 + 0.33$ . Multiplication of decimal numbers is similar to the multiplication of whole numbers. Steps for multiplication of decimals are given below with an example.

Consider multiplication of two numbers, 2.32 and 3 for example.

**Step 1:** Take the count of the total number of places (digits) to the right of the decimal point in both numbers.

Here, in 2.32 there are two digits to the right of the decimal point and 3 is a whole number with no decimal point. Therefore, the total number of digits to the right of the decimal is 2.

**Step 2:** Now forget about the decimal point and just multiply the numbers without the decimal point.

$$\begin{array}{r} 232 \\ \times 3 \\ \hline 696 \end{array}$$

Step 3: After multiplication, put the decimal point in answer 2 places (step 1) from the right i.e. answer ( $2.32 \times 3$ ) will be 6.96.

Simply, just multiply the decimal numbers without decimal points and then give decimal point in the answer as many places same as the total number of places right to the decimal points in both numbers.

### Division of Decimals

We can use the same trick we used in the multiplication of decimals i.e. remove the decimal points and divide the numbers like whole numbers.

Let's divide 40.5 by .20. Methods to divide these decimal numbers are as follows:

Method 1: Convert the decimal numbers into whole numbers by multiplying both numerator and denominator by the same number. *The denominator must be always a whole number.*

$$40.5 \div 0.20 = \frac{40.5}{0.20}$$
$$\frac{40.5}{0.20} = \frac{40.5 \times 5}{0.20 \times 5} = \frac{202.5}{1} = 202.5$$

(Multiply both the numerator and denominator by 5)

Method 2: Alternatively, one can convert decimal numbers into whole numbers by multiplying with numbers having powers of 10 (10, 100, 1000, etc.).

- Consider the denominator, count the number of places (digits) right to the decimal point.  
Here, the denominator is 0.20 and the number of digits right to the decimal point is 2.  
 $40.5 \div 0.20 = 40.5 / 0.20$
- Take the power of 10 the same as the number of digits right to the decimal point e.  $10^2 = 100$
- Multiply both numerator and denominator by 100.

$$\frac{40.5}{0.20} = \frac{40.5 \times 100}{0.20 \times 100} = \frac{4050}{20} = 202.5$$

### Multiplication and Division of Decimal Numbers by 10, 100 and 1000

Multiplication and division of decimals by numbers that have powers of 10 is easier than that by a whole number. Rules for multiplication and division of decimal numbers by 10, 100 and 1000:

Multiplication and Division		Rules	Examples
Multiply by 10 ( $10^1$ )	The number will move one place value to the left		$5.63 \times 10 = 56.3$
Multiply by 100 ( $10^2$ )	The number will move two places value to the left		$5.63 \times 100 = 563$
Multiply by 1000 ( $10^3$ )	The number will move three places value to the left		$5.63 \times 1000 = 5630$
Divide by 10 ( $10^1$ )	The number will move one place value to the right		$56.3 \div 10 = 5.63$
Divide by 100 ( $10^2$ )	The number will move two places value to the right		$56.3 \div 100 = 0.563$
Divide by 1000 ( $10^3$ )	The number will move three places value to the right		$56.3 \div 1000 = 0.0563$

### Multiplication and Division Equations

The equations are the expression that includes integers, variables, equality signs and arithmetic operations. For example,

$$2a + 9 = 7$$

If we solve the above equation for a, then,

$$2a = 7 - 9$$

$$a = -2 \div 2 = -1$$

### Solved Examples – Multiplication and Division

**Q.1: Find the product of:**

$$22 \times 11 = ?$$

$$3 \times 91 = ?$$

$$444 \times 3 = ?$$

$$1000 \times 8 = ?$$

**Solution:**

$$22 \times 11 = 242$$

$$3 \times 91 = 273$$

$$444 \times 3 = 1332$$

$$1000 \times 8 = 8000$$

**Q.2: Find the division of:**

$$34 \div 2 = ?$$

$$555 \div 5 = ?$$

$$81 \div 3 = ?$$

$$812 \div 4 = ?$$

**Solution: The divisions are:**

$$34 \div 2 = 17$$

$$555 \div 5 = 111$$

$$81 \div 3 = 27$$

$$812 \div 4 = 203$$

### Word Problems on Multiplication and Division

Q.1: There are 90 pencils in 1 box. How many pencils are there in 3 boxes?

Solution: Given, 1 box has 90 pencils.

So, in 3 boxes, number of pencils =  $3 \times 90 = 270$

Therefore, there are total of 270 pencils in 3 boxes.

Q.2: Raju has 1615 candies stored in a box. If there are 85 such boxes, then how many candies are there in each box?

Solution: Total number of candies = 1615

Number of boxes = 85

Therefore, each box contains =  $1615 \div 85$  candies  
= 19 candies.

### Practice Questions – Multiplication and Division

**1. Fill in the blanks:**

$$7 \times 9 = \underline{\quad}$$

$$83 \div 2 = \underline{\hspace{1cm}}$$

## 2. Find the value of:

$$\frac{2}{3} \times \frac{5}{9} = ?$$

$$\frac{5}{6} \times 12 = ?$$

$$16 \div \frac{4}{3} = ?$$

$$200 \div 40 = ?$$

3. Each toffee cost Rs. 2. If there are 120 toffees, then what is the total cost?

4. A school is planning a trip. There are 1729 students and each bus has 19 seats. How many buses are required to go for the trip?

To solve more problems on multiplication and division of decimals, download BYJU'S – The Learning App from Google Play Store and watch interactive videos.

## Frequently Asked Questions on Multiplication and Division

### What is the order of operations of multiplication and division?

As per the BODMAS rule, we divide first and then multiply, unless an expression is included in the bracket.

$$15 \div 3 \times 2 = 5 \times 2 = 10$$

$$15 \div (3 \times 2) = 15 \div 6 = 2.5$$

### What do we get when we multiply an integer with an integer?

Multiplication of an integer with an integer result in an integer itself.

Integer x Integer = Integer

### How do you divide a number by a fraction?

If we divide a number by a fraction, we need to find the reciprocal of the given fraction first and then multiply it with the dividend. Say, 3 is divided by  $\frac{1}{3}$ . Then,

$$3 \div (\frac{1}{3})$$

Reciprocal of  $\frac{1}{3}$  is 3

Therefore,

$$3 \times 3 = 9.$$

### How to multiply decimal by a fraction?

If we have a decimal and a fraction to multiply, then we can convert the decimal into a fraction and then multiply with another fraction.

$$0.5 \times \frac{1}{3}$$

$$0.5 = \frac{5}{10} = \frac{1}{2}$$

$$\frac{1}{2} \times \frac{1}{3} = \frac{1}{6}$$

### Is multiplication and division applicable to all the real numbers?

We can multiply and divide all the real numbers such as whole numbers, natural numbers, integers, rational numbers, irrational numbers.